We claim:

1. A lightning detection system, comprising:

a source of an electrical detection signal representative of the derivative of an electromagnetic field from a lightning discharge;

an analog-to-digital converter, responsive to said electrical detection signal, for producing a digital detection signal representative of the derivative of said electromagnetic field; and

a digital processor, responsive to said digital detection signal, for determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal, said digital processor continually processing said digital detection signal so as to eliminate dead time between lightning events.

2. The lightning detection system of claim 1, further comprising a signal conditioning element responsive to said electrical detection signal for removing noise therefrom while maintaining the derivative state of components of said electrical detection signal deemed most significant and thereby producing a conditioned detection signal.

3. The lightning detection system of claim 2, wherein said signal conditioning element comprises a leaky analog integrator which substantially blocks signal components whose frequencies are above a cutoff threshold while substantially passing components of said electrical detection signal deemed most significant without integration thereof.

4. The lightning detection signal of claim 2, further comprising a non-linear amplifier, responsive to said conditioned detection signal, for producing an amplitude compressed conditioned detection signal having a reduced dynamic amplitude range prior to application to said analog-to-digital converter.

5. The lightning detection system of claim 4, wherein said non-linear amplifier is a logarithmic amplifier.

6. The lightning detection system of claim 4, wherein said non-linear amplifier is a piece-wise linear amplifier.

7. The lightning detection system of claim 1, further comprising a non-linear amplifier, responsive to said electrical detection signal, for reducing the dynamic amplitude range of said electrical detection signal prior to its application to said analog-to-digital converter.

8. The lightning detection system of claim 7, wherein said non-linear amplifier is a logarithmic amplifier.

9. The lightning detection system of claim 7, wherein said non-linear amplifier is a piece-wise linear amplifier.

10. The lightning detection system of claim 1, wherein said digital processor includes an integration element for digitally integrating said digital detection signal and thereby producing an integrated digital detection signal, said processor using both said digital detection signal representative of the derivative of said electromagnetic field and said integrated digital detection signal to determine the type of lightning discharge that produced said electromagnetic field.

11. The lightning detection system of claim 10, further comprising an amplifier, responsive to said electrical detection signal, for reducing the dynamic amplitude range of said electrical detection signal prior to its application to said analog-to-digital converter.

12. The lightning detection system of claim 11, wherein said amplifier is a logarithmic amplifier.

13. The lightning detection system of claim 11, wherein said amplifier is a piece-wise linear amplifier.

14. The lightning detection system of claim 10, further comprising a signal conditioning element responsive to said electrical detection signal for removing noise therefrom while maintaining the derivative state of the components of said detection signal deemed most significant prior to application to said analog-to-digital converter.

15. The lightning detection system of claim 14, wherein said signal conditioning element comprises a leaky analog integrator which substantially blocks signal components whose

frequencies are above a cutoff threshold while substantially passing said components of said detection signal deemed most significant without integration thereof.

16. The lightning detection system of claim 10, wherein said digital processor employs said digital detection signal representative of the derivative of said electromagnetic field to identify maxima and minima of the waveform of said integrated digital detection signal, and identifies zero crossings of said integrated digital detection signal from said integrated digital detection signal itself.

17. The lightning detection system of claim 16, wherein said digital processor distinguishes between cloud-to-ground and intra-cloud lighting discharges.

18. The lightning detection system of claim 1, wherein said digital processor produces digital data characterizing lightning discharges, and said system further comprises a data transmission component for transmitting said characterizing data over a communications channel.

19. The lightning detection system of claim 18, comprising a plurality of sources, associated analog-to-digital converters and associated digital processors, and a central analyzer for receiving said characterizing data, said central analyzer including a discharge correlation component for correlating pulses from said plurality of sources to determine the time and location of a discharge.

20. The lightning detection system of claim 19, wherein said transmission component includes a data compression component for reducing the amount of data needed to characterize a lightning discharge so as to decrease the time or bandwidth required to transmit a complete data set representative of a series of lightning discharges.

21. The lightning detection system of claim 20, wherein said data compression component minimally transmits, for each series of discharges, sufficient characterizing data to identify the amplitude of the largest pulse produced thereby and the time when said largest pulse occurred.

22. The lightning detection system of claim 20, wherein said data compression component includes a data decimation component for synchronously decimating said characterizing data when needed to accommodate the bandwidth of said communications channel.

23. A lightning detection system, comprising:

a source of an electrical detection signal representative of an electromagnetic field from a lightning discharge;

a non-linear amplifier, responsive to said electrical detection signal, for producing an amplitude compressed detection signal having a reduced amplitude dynamic range; and

a signal processor responsive to said amplitude compressed detection signal for determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said amplitude compressed detection signal.

24. The lightning detection system of claim 23, wherein said non-linear amplifier is a logarithmic amplifier.

25. The lightning detection system of claim 23, wherein said non-linear amplifier is a piece-wise linear amplifier.

26. The lightning detection system of claim 23, further comprising an analog-to-digital converter, responsive to said amplitude compressed detection signal, for producing an amplitude compressed digital detection signal for application to said signal processor, and said signal processor comprises a digital processor.

27. The lightning detection system of claim 26, wherein said digital processor employs said amplitude compressed digital detection signal representative of said electromagnetic field to identify maxima and minima of the waveform of said amplitude compressed digital detection signal, and identifies zero crossings of said amplitude compressed digital detection signal.

28. The lightning detection system of claim 27, wherein said digital processor distinguishes between cloud-to-ground and intra-cloud lightning discharges.

29. The lightning detection system of claim 23, wherein said signal processor produces digital data characterizing lightning discharges that are identified, and said system further comprises a data transmission component for transmitting said characterizing data over a communications channel.

30. The lightning detection system of claim 29, wherein said transmission component includes a data compression component for reducing the amount of data needed to characterize a lightning discharge so as to decrease the time or bandwidth required to transmit a complete data set representative of a series of lightning discharges.

31. The lightning detection system of claim 30, wherein said data compression component minimally transmits, for each series of discharges, sufficient data to identify the amplitude of the largest pulse produced thereby and the time when said largest pulse occurred.

32. The lightning detection system of claim 29, wherein said data compression component further comprises a data decimation component for synchronously decimating said characterizing data when needed to accommodate the bandwidth of said communications channel.

33. The lightning detection system of claim 29, further comprising a central analyzer component for receiving and processing said characterizing data.

34. The lightning detection system of claim 33, comprising a plurality of sources, associated non-linear amplifiers, and associated digital processors, and wherein said central analyzer component includes a discharge correlation component for correlating pulses from said plurality of sources to determine the time and location of a discharge.

35. The lightning detection system of claim 23, wherein said source comprises an antenna.

36. A method for detecting lightning, comprising:

producing in response to an electromagnetic field from a lightning discharge an electrical detection signal representative of the derivative of said electromagnetic field;

producing, in response to said electrical detection signal, a digital detection signal representative of the derivative of said electromagnetic field; and

determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said digital detection signal while continually processing said digital detection signal so as to eliminate dead time between lightning events.

37. The lightning detection method of claim 36, further comprising conditioning said electrical detection signal to remove noise therefrom while maintaining the derivative state of components of said electrical detection signal deemed most significant and thereby producing a conditioned detection signal.

38. The lightning detection method of claim 37, wherein said conditioning step comprises substantially blocking signal components whose frequencies are above a cutoff threshold while substantially passing a portion of said electrical detection signal deemed most significant without integration thereof.

39. The lightning detection method of claim 37, further comprising producing from said electrical detection signal an amplitude compressed conditioned detection signal having a reduced amplitude dynamic range prior to producing said digital detection signal.

40. The lightning detection method of claim 39, wherein said amplitude compressed conditioned signal is produced by logarithmic amplification.

41. The lightning detection method of claim 39, wherein said amplitude compressed conditioned signal is produced by piece-wise linear amplification.

42. The lightning detection method of claim 36, further comprising reducing the dynamic amplitude range of said electrical detection signal by non-linear amplification prior to producing said digital detection signal.

43. The lightning detection method of claim 42, wherein said reducing the dynamic amplitude range is accomplished by logarithmic amplification.

44. The lightning detection method of claim 42, wherein said non-linear amplification is accomplished by piece-wise linear amplification.

45. The lightning detection method of claim 36, further comprising digitally integrating said digital detection signal and thereby producing an integrated digital detection signal, and using both said digital detection signal representative of the derivative of said electromagnetic field and said integrated digital detection signal to determine the type of lightning discharge that produced said electromagnetic field.

46. The lightning detection method of claim 45, further comprising amplifying said electrical detection signal so as to reduce the dynamic amplitude range of said electrical detection signal prior to producing said digital detection signal.

47. The lightning detection method of claim 46, wherein said amplifying is accomplished by logarithmic amplification.

48. The lightning detection method of claim 46, wherein said amplifying is accomplished by piece-wise linear amplification.

49. The lightning detection method of claim 45, further comprising removing noise from said electrical detection signal while maintaining the derivative state of components of said electrical detection signal deemed most significant prior to producing said digital detection signal.

50. The lightning detection method of claim 49, further comprising substantially blocking signal components whose frequencies are above a cutoff threshold while substantially passing components of said detection signal deemed most significant without integration thereof.

51. The lightning detection method of claim 45, further comprising using said digital detection signal representative of the derivative of said electromagnetic field to identify maxima and minima of the waveform of said integrated digital detection signal, and identifying zero crossings of said integrated digital detection signal from said integrated digital detection signal.

52. The lightning detection method of claim 51, further comprising distinguishing between cloud-to-ground and intra-cloud lightning discharges.

53. The lightning detection method of claim 36, wherein said determining the type of lightning discharge includes producing digital data characterizing lightning discharges that are identified, and said method further comprises transmitting said characterizing data over a communications channel.

54. The lightning detection method of claim 53, comprising producing a plurality of electrical detection signals from different locations and correlating pulses from said plurality of detection signals to determine the time and location of a lightning discharge.

55. The lightning detection method of claim 53, wherein said transmitting includes reducing the amount of data needed to characterize a lightning discharge so as to decrease the time or bandwidth required to transmit a complete data set representative of a series of lightning discharges.

56. The lightning detection method of claim 55, further comprising minimally transmitting, for each series of discharges, sufficient data to identify the amplitude of the largest pulse in said characterizing data and the time when said largest pulse occurred.

57. The lightning detection method of claim 56, further comprising synchronously decimating said characterizing data where needed to accommodate the bandwidth of said communications channel.

58. A lightning detection method, comprising:

producing in response to an electromagnetic field from a lightning discharge an electrical detection signal representative of the derivative of said field;

amplifying said electrical detection signal so as to produce an amplitude compressed detection signal having a reduced dynamic range; and

determining the type of lightning discharge that produced said electromagnetic field based on characteristics of said amplitude compressed detection signal.

59. The lightning detection method of claim 58, wherein said amplifying is accomplished by logarithmic amplification.

60. The lightning detection method of claim 58, wherein said amplifying is accomplished by piece-wise linear amplification.

61. The lightning detection method of claim 58, further comprising converting said amplitude compressed detection signal to digital form before determining the typeo f lightning discharge that produced said electromagnetic field.

62. The lightning detection method of claim 61, further comprising identifying maxima and minima and zero crossings of said digital amplitude compressed detection signal.

63. The lightning detection method of claim 62, further comprising distinguishing between cloud-to-ground and intra-cloud lightning discharges based on said maxima and minima and zero crossings.

64. The lightning detection method of claim 58, further comprising producing from said amplitude compressed detection signal digital data characterizing lightning discharges that are identified and transmitting said characterizing data over a communications channel.

65. The lightning detection method of claim 64, further comprising reducing the amount of data needed to characterize a series of lightning discharges so as to decrease the time or bandwidth required to transmit said characterizing data.

66. The lightning detection method of claim 65, further comprising minimally transmitting, for each series of discharges sufficient data to identify the amplitude of the largest pulse in said characterizing data and the time when said largest pulse occurred.

67. The lightning detection method of claim 66, further comprising synchronously decimating said characterizing data when needed to accommodate the bandwidth of said communications channel.

68. The lightning detection system of claim 64, further comprising producing a plurality of electrical detection signals and correlating pulses from said plurality of detection signals to determine the time and location of a discharge.

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